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ABSTRACT

A series of studies are underway at the Massachusetts Institute of Technology's Audience Research Facility to examine the impact of interactivity on informational and entertainment based television viewing. In order to examine the learning of spatial skills from videogames, the first study compared the learning of spatial content from interactive (user controlled) and observational (television) media. Pre-existing cognitive styles, specifically the abilities of haptic perception and locus of control, were found to influence the subject's ability to perform with the two types of media. The second study will explore the influence of user control and interactive structure on learning from television news, as well as the influence of modality preference and pre-existing media usage patterns. The final study in the series will examine the influence of user control and interactive structure on viewers' identification and involvement with characters in the television program "Dallas." The influence of subjects' general empathy level and pre-existing media patterns will also be explored. This paper summarizes the results of the first study, describes the two follow-up studies to be conducted, and discusses the following topics as they relate to the research: (1) features of interactive television; (2) user control; (3) interaction of structure and content; (4) interactive structure; and (5) the influence of user characteristics. A 48-item bibliography is provided. (Author/MES)

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Interactive Television: The Influence of User Control and Interactive Structure

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Interactive Television:The Influence of User Control and Interactive Structure

Abstract:

A series of studies are underway at M.I.T.'s Audience Research Facility examining the influence of user control on learning and entertainment television viewing. This paper summarizes the results of the first study in the series and describes two follow up studies that are currently in progress. A theoretical model is also proposed for the examination of different forms of interactivity. The first study in the series compared learning of spatial content from interactive (user controlled) versus observational (television) media. Pre-existing cognitive styles (haptic perception, and locus of control) were found to influence the the subject's ability to perform with the two types of media. The second study explores the influence of user control and interactive structure on learning from television news. The influence of modality preference, and pre-existing media usage patterns will also be investigated. The final study in the series will examine the influence of user control and interactive structure on identification and involvement with characters in the television program Dallas. The influence of subjects general empathy level and pre-existing media patterns will also be explored.

With the integration of video and computers, the traditional mode of passive television viewing may soon be receiving competition from a new form of user controlled television interaction. Instead of simply watching television programs the audience may someday be interacting and controlling various aspects of the program content. Today videodiscs, interactive video and two way cable systems are all capable of providing the user with increased control over video content and format. In the future, condensed video on Compact Discs (CD), and broadband fiber optic systems may also include interactive motion video. How will this interactive television differ from traditional television?

When computing capabilities are added to video or television, the

resulting media retains many of the same formal features as traditional television. The fundamental difference between traditional linear television and the next generation of interactive television is the addition of user control and new alternatives for the structuring of information.

A series of studies is now underway at the Massachusetts Institute of Technology's Audience Research Facility that examines the impact of interactivity on informational and entertainment based television viewing. More specifically these studies examine the potential influence of user control and interactive structure on: 1. the learning of spatial skills from videogames 2. the acquisition of political information from television news, and 3. emotional involvement and character identification with entertainment programming.

In order to examine the effects of a media change (such as the addition of user control) characteristics of the media, the user, the task, and the content must all be taken into account. An experimental approach is employed in these studies that examines the differences that result from exposure to interactive versus observational versions of the same content. Although all three studies involve the same methodology and examine the same media characteristics (i.e. user control and interactive structure); each study examines the unique interactions that result from different content, task, and user characteristics (see figure 1).

To examine the influence of interactive versus observational media; five topics must be addressed: 1). features of interactive television, 2). user control, 3). the interaction of structure and content 4). interactive structure and 5). the influence of user characteristics. Each of these areas will be briefly outlined as they relate to the study series.

Features of Interactive Television

What is interactive television? When a computer and a television set are connected the resulting media is interactive television or interactive video. The addition of the computer provides a range of user control capabilities such as random access, graphic overlay, and the ability to manipulate or program video images and sequences. This can provide the user with significant control over program content

Truly interactive television in the home is not yet a reality. A few interactive cable systems (such as HI OVIS in Japan and the QUBE system in the US) have tried to provide simple prototype versions of interactive programming but the interactive programming they have provided had little in common with mainstream prime time television. In most cases, interactive television programming: has side stepped existing television formats and conventions, has had inferior production values and has presented programs that are little more than video voting booths. To examine the true differences between interactive and observational television other already existing interactive media such as computers, videogames, and videodiscs, must serve as models.

When examining interactive and observational media it is apparent that the two media have many features in common. For example, when a computer is added to a videodisc or videotape, the resulting medium still retains the same formal features (e.g., zooms, camera angles, slow motion, fades, etc.) as its noninteractive video relative. The difference between learning through traditional linear formats and interactive formats is a fundamental one dealing primarily with user control and the structuring of information.

Interactivity is a complex phenomenon. Some forms, such as simulations and videogames, provide continuous real time control and manipulation of objects and events. Others provide a branching structure in which the user makes selections and directs the presentation of the content from a set of options, while

others simply provide feedback to responses but still guide the user along a

predetermined path. Thus, the amount of user control over the content, the structure, the layout of the information, and the form of feedback or response provided to the user may vary significantly in different interactive applications.

Identifying the features that define a medium as interactive is a complicated task. A medium may have a number of attributes that are not always used. The popular literature often defines interactive video media in terms of its hardware capabilities such as still frame, dual audio channels, chapter stops, storage capabilities and computer interaction. It is also common to hear of interactivity defined in one to three levels, again based on hardware configurations and computing power (e.g. Schwartz, 1985). Within this model, level one refers to a straight video play systems where interactivity is limited to the inboard controls on the videotape or videodisc player (e.g. fast forward, rewind etc.). Level two refers to videodisc players with built-in microprocessors that serve as low powered stand alone interactive systems, while level three refers to videodisc players connected to microcomputers or mainframe computers. These level three systems feature full programming capabilities, graphic overlay and various interface devices.

Many educational designers have also identified a number of interactive design features (e.g. Gayeski & Williams, 1980; Jonassen, 1984; Nugent & Stone, 1980). Blum Cohen (1984) summarized these interactive features as: a). nonlinear format of content, b). the presence of user control options, c). feedback, d). modular organization of content, e). flexibility of user needs, and f). the use of video still frame databanks.

It is difficult to identify an overriding heuristic to separate what constitutes interactivity from its structural or formal features. Interactive media can utilize any number of formal video and computer design features. The term interactivity implies mutual or reciprocal action or influence. Therefore, the primary identifying features of interactive media can be seen as dealing with control and structuring of information. In order to examine the influence of interactive media, it is necessary to hold all the features of the media constant and examine one variable at a time. Cross media comparisons which fail to hold

these variables constant may reach misleading conclusions.

This study series utilizes a yoked experimental design that varies the amount of user control and the interactive structure while holding other variables such as content and task orientation constant. Through a yoking technique, the subjects in condition 2 (observing the interactive program) will receive exactly the same visual material and interactive structural displays, branching, pace and sequencing of information as the subjects in condition 1 (using the interactive version). The only identifiable difference between these two conditions is user control.

The second and third studies in the series will add a third condition. The subjects in condition 3 (the linear version) will see the same program as the other two conditions, however, they will not have user control or the presence of the interactive structure. This version will be a linear version of the program as it would appear on traditional television. The identifiable differences between this condition and the other two conditions are the presence of interactive structure and user control.

User Control

Although the idea of user control has been not widely examined in the area of entertainment, it has been studied in the area of education. Over the years many educators and theorists have advocated methods of instruction in which the learner is given greater self-direction or control over learning (e.g., Bork, 1981; Dewey, 1959; Schwartz in Richards, 1982). Some studies which have examined student controlled learning have shown striking increases in learning effectiveness (Mager & McCann, 1961; Mager & Clark, 1963; Grub & Selfridge, 1964). Other studies which have employed more stringent controls have found no significant differences (Gallagher, 1970; Campbell, 1964). These findings have led some educators to conclude that there is little evidence to support the belief that learner control actually produces improved learning or feelings of self-efficacy

(Fry, 1972; Snow, 1980).

Several studies have examined the role of student preference in various learning situations and have found no advantage in providing students with their preference (Cronbach & Snow, 1977). In reviewing these studies Clark (1980) concluded that students learned least from the method they enjoyed the most.

Although user control may not produce increases in learning it may influence preferences and motivation (Manning, 1983). A study comparing user controlled and observational media found that subjects preferred interactive to passive media presentations of the same content (e.g. Gagnon, 1985). Subjects rated the interactive presentation of spatial content significantly higher on enjoyment and liking than the observational presentation. This suggests that interactive media could be more enjoyable and as such may have potential for motivating users.

For television this motivation may be a vital component in holding viewers. Unlike much of education, television is a voluntary act and as such must be intrinsically motivating. In the case of television news viewing, the goals may be different from other task oriented information seeking. News viewing may also have different goals than pure entertainment television viewing and as such may be differently influenced by the addition of user control. The proposed studies will examine the differences that result from adding user control and interactive structure to information and entertainment television content.

The Interaction between Structure and Content

The design of effective interactive structure can be said to be derived from an intersection of content and task. Thus the nature of the content influences, if not determines the type of interactive structure it will support.

Informational content easily lends itself to a number of interactive structures or hierarchies. Information can be arranged or categorized into an a variety of lesson divisions, or thematic associations or hierarchies based on the learning task at hand. A number of interactive design conventions have resulted

that deal with user performance and feedback design, modular structuring, selection of chapter and lesson order, and data base and archive design (e.g. Iuppa, 1984).

Entertainment content, on the other hand, does not lend itself as easily to interactive structuring. Much of traditional entertainment television content is based on stories with linear plots. Furthermore, the goal involved in entertainment viewing is not easily defined. It may be for these reasons that few interactive entertainment video or videodisc products exist (with the exception of videogames).

Videogames , unlike television programs do not feature well developed plots or story lines. Videogames can be most closely compared to television cartoons (see Gagnon, 1986). Similar to cartoons videogames provide a general scenario in which a series of activities are enacted. Because of this simple plotless approach videogames are able to provide the user with real time user control and the ability to determine outcomes within a narrowly defined scenario. (Because of this high level of user control a videogame was used in the first study in the series).

Unlike educational television and videogames, the current formats that exist for entertainment television do not easily lend themselves to interactive retrofitting. Entertainment television consists of sitcoms, soap operas, action adventure shows, game shows, talk shows, sports, variety shows, music video, and feature films. Each of these content types has an associated format that is rarely varied.

Game shows, talk shows, sports, and variety shows do not present linear stories or narrative structures. Sitcoms, action adventure and most feature films are usually based on linear stories that have a beginning, middle and end. Occasionally flashbacks and other cinemagraphic conventions are used that vary the chronological order of events, but as a whole, the parts must be viewed in a linear order to make sense. It is therefore hard to allow user control over events if the scenes must be viewed in a predetermined order.

The soap opera format provides a unique exception to the typical linear plot. Although soap operas are narrative stories, they are presented as a series of

simultaneously developing subplots that are revealed piece by piece. Each scene portrays a small piece of a number of different simultaneously developing stories. In some episodes the only connection between the individual scenes is that they are assumed to all be happening at approximately the same time. Therefore the scenes within a given episode do not have to be viewed in a set order. This ability to reorder scenes makes this television format easier to adapt into an interactive format. A soap opera was therefore selected for use in the third study in the series.

To examine the potential relationship between content, format and user control, three types of content were selected for use in this study series. Although the goal was to study television, a videogame was selected for use in the first study because: a. videogames represent one of the only existing forms of interactive entertainment and b. videogames provide a high level of user control (i.e. real time control over action and characters). A videogame called Battlezone was chosen based on previous research (Gagnon, 1986). The CBS evening news (an information based format) was selected for the second study. This will allow for the exploration of a range of approaches to information structuring. For the third study, an interactive version of the soap opera Dallas was chosen.

There are significant differences in the interactive structure that are possible with these different types of content. In order to understand these differences, a theoretical framework or model must exist for comparing them.

A Model for Interactive structuring

To date there have been very few models proposed for examining the different forms of interactivity. Without this type of coherent framework, it is hard to understand the differences between the alternative approaches that are used in the interactive structuring of content.

It can be proposed that the film making process itself be used as a theoretical model for examining the various forms that television based interactivity can take . A partial analogy can be drawn between the hierarchy of roles involved in creating a film and the basis of interaction that can be employed

for existing entertainment formats. The hierarchy of 1). Audience, 2). Editor, 3). Writer, and 4). Actor can be seen as a simple analogous model for examining entertainment based interaction.

Audience: At the lowest level, interactivity can be based on a view/not view choice. Television today is interactive on this level. The audience in front of a television show can pick a channel or turn the television set on or off. Recently the wide spread use of remote control devices has lead to what the industry has dubbed Zapping. Instead of selecting a show and watching it, many viewers now switch (zap) between shows watching partial shows, or more than one show at a time. In this type of audience interactivity the user has no control over the individual shows but only a choice to view or not to view them.

Editor: The next level of interactivity an be seen as analogous to the function of an Editor. In this case, the user has control over the sequencing and assembling of individual scenes within the show. Many educational videodiscs allow users to pick the order in which the chapters of a lesson plan are viewed. In the case of interactive entertainment content, the user could choose and assemble individual scenes much like an editor. For example, the user could choose to see only the soap opera scenes that relate to their favorite characters. In this case the user may only assemble from a set pool of scenes, but can not determine the outcome of the individual scenes.

Writer: On the next level of interactivity the user is allowed to act as a writer, determining or voting on the actual outcomes of individual scenes. Many videodiscs are designed with multiple choice branching structures to determine the outcome of events. In the case of entertainment content, the user could be actively involved in determining outcomes or evolutions in the narrative structure or story. Few interactive entertainment video products have attempted to allow users this level of control over a narrative story. A few examples such as *Murder Anyone?* have tried this approach with some success. To date the number of choices and the nature of the choices available have been very limited.

Actor: The final form of interactivity would be the user as actor participating in the television show or movie. Through real time interaction and

transparent input, the users may some day be able to interact as a character within the movie. Videogames, to a limited degree, allow the user to be an actor in a real time scenario. The scenarios were, however, plotless structures that could be compared to cartoon structures (see Gagnon, 1983). These examples are very far from a true interactive television which would have a developed story line of events and real characters with which to enact them with.

As the technology develops, interface devices such as the body tracking device developed at M.I.T. (Ginsberg, 1983) can be used within high resolution real time graphic or digitized environments to allow users to physically maneuver within scenes. Other approaches based on physiological or emotional responses, or based on individual profile features or previously polled preferences, may also be tried which do not interrupt the scenes with intrusive interactive structures.

Some forms of entertainment content may support the use of more traditional educational interactive conventions such as databases of additional information. For example, some one watching a soap opera may wish to access a flow chart of a family tree to determine the relationship between two characters, or see the history of a new character that is introduced. Such requirements would allow for the integration of conventional videostill frame or video databases and access structures.

In the first study of the interactivity series, a videogame named Battlezone was used. This game provided a real time level of interactivity that could be seen as a primitive example of the actor level of interactivity. For the next two studies in the series two videodiscs are being designed. Existing television content will be retrofitted to include limited interactive structures based on the editor and writer forms of interactivity. The use of informational data bases will also be explored.

To examine the potential influence of user control and interactive structure, an experimental methodology comparing interactive versus observational versions of the same content will be incorporated. The influence of various individual differences and cognitive styles will also be explored.

There have been many studies that have shown aptitude treatment interactions (ATI) when using various types of user control (e.g. Fry, 1972; Greene, 1976; Kulik, kulik, & Cohen, 1979). The research has clearly shown that no form of user control can erase the relevance of prior individual differences.

This was also found in studies examining educational media such as television and film (for reviews see Cronbach & Snow, 1977; Salomon, 1979). Since all media require the use of underlying skills for extracting information, individual differences in the aptitudes of the user interact with the media and affect learning (e.g. Ausburn & Ausburn, 1978; Cronbach & Snow, 1977; Olsen & Bruner, 1974).

It is believed that learning is best facilitated if there is a close correspondence between the user's internal representation and the media's mode of representation. When there is a poor match between the media's mode of representation and the user's internal modes of representation, additional translation is required; that is, externally coded messages often need to be transferred and translated into one's preferred (or task required) symbol system (Salomon, 1979).

Aptitude treatment interaction hypotheses can be tested which predict that learners with cognitive skills that match the media will perform better than those with opposed skills. Each of the studies in the proposed series will examine different underlying cognitive or emotional processes. It is hypothesized that these variables influence the user's ability to deal with the different user control characteristics of the interactive and observational media.

Study 1 -Interactive Versus Observational Videogames

Study 1 attempted to determine 1) if interactive technologies such as videogames were better able to cultivate underlying spatial skills than their observationally based predecessors such as television; and 2. to determine if cognitive style variables influence the ability to use interactive versus observational media.

This study examined characteristics of the media (user control), the task requirement (spatial visualization), and the learner (haptic perception, locus of control, and active/passive learning preference) to determine the influence of user control on the learning of content and underlying spatial skills.

There has been some speculation concerning the possible beneficial effects of videogames. It had been proposed that videogames can teach a range of cognitive skills, increase attention spans and concentration, and improve spatial visualization, eye-hand coordination, and inductive reasoning skills (see Gagnon, 1983 for review).

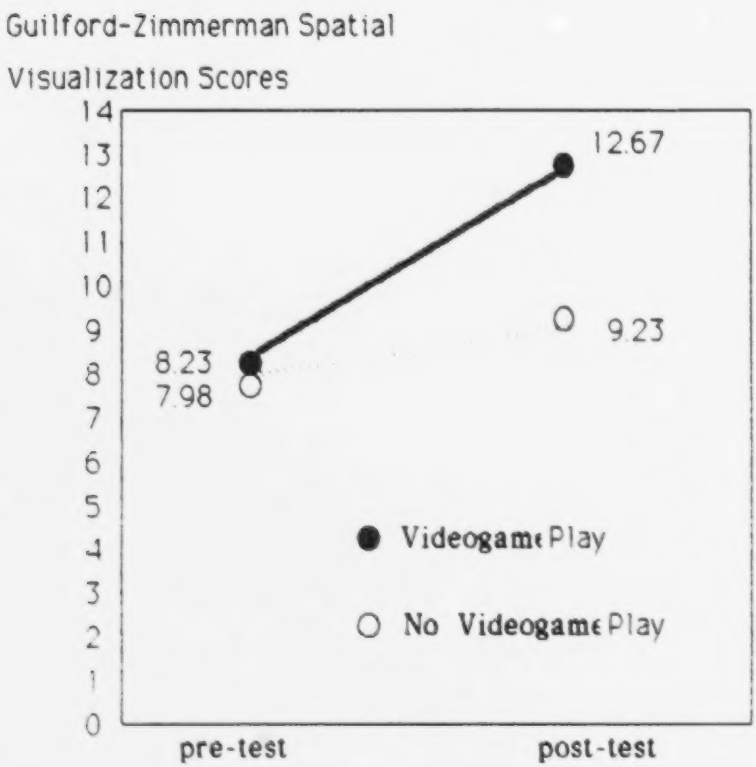
An exploratory study (Gagnon, 1983, 1986) was conducted that attempted to examine this potential relationship between videogames and spatial cognitive skills. Fifty-eight Harvard undergraduate and graduate students participated in the pilot study. Scores on two videogames were correlated with subjects' scores on three standardized tests. A significant relationship was found between the scores on the videogames and scores on spatial tests; however, the different videogames appeared to utilize or be related to different types of cognitive skills. Although the males initially scored higher on both the videogame and the spatial tests, the women were able to equal the men's scores after five hours of videogame practice.

The most intriguing finding was that the women who were provided with videogame practice subsequently obtained higher scores on spatial visualization than the women who were not provided with videogame practice (see Figure 2). This suggests that three dimensional videogames may be utilizing and providing valuable practice in the underlying spatial skills that are measured by the

Guilford-Zimmerman standardized spatial aptitude test.

Figure 2.

The Influence of Videogame Practice on Female Visualization Scores



$F(1, 24) = 4.76$, $p < .05$

Gagnon, 1983

A question can be raised whether this increase in spatial scores can be attributed to the experiential learning which is unique to this type of interactive media, or simply the result of being visually exposed to the spatial relationships presented on the screen. The current study attempted to determine whether the underlying influencing mechanism to effect this increase was a result of the interactive contingent learning or simple visual exposure and observational learning.

Videogames present a symbolic world in which the player can interact and

internalize operations and rules which generalize to the physical world. This learning process most closely parallels the learning of spatial skills through the manipulation of objects in Euclidean space. As Piaget (1954) suggests, this learning primarily takes place through the manipulation of physical objects which leads to conceptualization, internalization of operations and then the temporal ordering of operations. Through this process, an understanding of physical order and logical relationships emerges (Piaget, 1952; 1954). Such a process may also take place in videogame learning, where the player can actively manipulate visual representations of objects that function according to a set of fixed rules.

Similar to the manipulation of objects in the physical world, videogames allow the user to carry out a number of manipulations such as the rotation of objects in space, the serial arrangement of objects, etc. Parallel to physical activities, these simulated activities may come to be internalized and form a part of the internal constructs that constitute the basis of spatial cognitive reasoning.

Alternatively, the manipulation of the objects provided by the videogames may not be the salient factor. Some spatial abilities have shown improvement through exposure to observational media such as television and film (Ball & Bogantz, 1970; Rovet, 1975; Salomon, 1979). Piaget also does not discount the influence of observation in the development of spatial reasoning (Piaget, 1952). It may be that players can internalize these constructs in a vicarious manner by visual exposure to the movements and rotations presented on the screen.

Students are often expected to acquire a concept through television, film, or other observational processes. Although a great deal of learning can be transmitted to observers through modeling, imitation theory predicts that there is greater difficulty in modeling more complex behavioral sequences (Bandura, 1965). When concept attainment requires the use of complex strategies or rules, the solution cues learned by the observer may not constitute a sufficient sample to permit both rule and attribute attainment (Bandura & Walters, 1963).

Vicarious as compared to direct transfer has been shown to be less efficient in difficult tasks (Simon & Ditrichs, 1968). Bandura and Walters (1963) suggest that it is more typical for the observer to learn larger segments or behavior

patterns rather than stimulus-response subunits. Since videogames utilize complex strategies and are primarily learned at the stimulus-response level, it appears that observational learning of videogames may be difficult.

If media utilize and promote different cognitive skills or styles, then it can be proposed that there may be measurable differences in the learning that takes place and the strategies incorporated. If it was the manipulation or "interaction" provided by the videogames that cultivated the observed increases in spatial skill found in Gagnon's study (1983), then it may be hypothesized that: those subjects who are allowed to interact with the videogame will show more improvement on spatial visualization scores and will incorporate more complex spatial strategies than the subjects who simply observe the videogames.

It was further hypothesized that there would be cognitive style variables that would interact with ability to perform with the interactive and observational versions of the videogame. The cognitive style variables under examination in this study were: haptic perception, locus of control and preference for active versus passive learning situations.

Haptic Perception

Visual Haptic Perception is a factor of cognitive style that deals with a learner's preference for using visual or kinesthetic sensory input and processing (Lowenfeld, 1945; Lowenfeld and Brittain, 1970). This preference for dealing with information via visual or kinesthetic senses, results in very different learning needs and abilities. Visually oriented learners prefer to gain information through visual means. They tend to show a greater ability to analyze and integrate visual details, to mentally convert nonvisual information into visual, and to show superior retention of mental images. They also have been said to see experiences from a spectator point of view. Haptic oriented learners tend to prefer kinesthetic and physical means. They tend: to refuse to integrate details and partial impressions, to internalize nonvisual information kinesthetically rather than convert them into visual information, and to feel experiences subjectively.

These different tendencies to process information may influence how well

the learner interacts with different media to learn the underlying skills. In the case of interactive videogames, it might be proposed that the ability to kinesthetically and physically respond to the spatial manipulations is a requirement. Those learners who favor the haptic mode of processing information may be better suited to this type of media. To learn the same spatial information by observing the videogames requires strong abilities to attend to visual detail and integrate these visual details into rules. It might be suggested that those learners who preferred a visual mode of processing might be better able to learn from this type of media. Therefore, it was hypothesized that: Those subjects who favor the haptic mode will perform better with interactive media, while those subjects who favor the visual mode will perform better with the observational media.

Locus of Control

Locus of control is an individual difference variable that deals with beliefs about the amount of control an individual has over life events (see Lefcourt, 1976 for review). People who believe that they have control over events and feel personally responsible for the things that happen to them are labeled as Internals. Others who feel that their outcomes are determined by forces beyond their control (e.g. luck, fate, or powerful others) are labeled as Externals.

Locus of control is believed to be a relatively enduring dispostional characteristic which can be measured by a range of tests. The measure chosen for this experiment was the Levenson's Internal, Chance, and Powerful Others Scales (ICP scales). This measure differentiates between two types of external orientation: beliefs in the basic unordered and random nature of the world (i.e. chance or fate), and the expectancy that powerful others are in control. Inherent in this type of testing is the assumption that a person who believes in chance control may be cognitively and behaviorally different from one who feels a lack of personal control. (Levenson 1972).

Locus of control may therefore have an effect on how well a subject performs on interactive and observational media. It may be that internals (who believe that they have control) prefer and are better able to use control when

provided with the option. This group may perform better when exposed to interactive media which provides such control. Externals (who do not believe that they have control) may prefer situations where they do not have to be in control. This group may prefer and perform better with observational media which does not provide user control and, as such, meets with their pre-existing expectations of the world. In this study, it was predicted that subjects would perform better with media that presented the type of control situation that matched the subjects pre-existing expectations or cognitive set. More specifically, it was hypothesized that: Those who are classified as external on locus of control would do better in the observational condition, while those rated as internal would do better in the interactive condition.

Interactive Versus Spectator Preference

Preference for interactive or spectator learning situations may also be related to a learner's beliefs in locus of control. If internals do prefer and are better able to use control than externals, they may also tend to prefer a number of different types of learning situations that allow student control or input.

A series of pilot interviews were conducted with subjects that rated as extremes on an interactive or spectator learning preference questionnaire (see Gagnon, 1986). These preferences for interactive or spectator learning also seemed to extend to other activities.

Although people do not always learn better in situations they prefer (Clark 1980), they may be more motivated to enjoy and pursue these activities. Therefore, it was hypothesized that: Those who preferred learning in interactive situations would score higher in this condition, while those who preferred spectator learning situations would score higher in this condition.

Method Study 1

Ninety female subjects (between the ages of 18 and 40) were recruited at the Liberty Tree Mall in Danvers Massachusetts and escorted to M.I.T.'s Audience Research Facility. Subjects were pretested on one half of the Guilford Zimmerman Spatial Visualization Test. They were matched into groups of three based on their score, and then randomly assigned to one of three conditions.

They were then given three tests of haptic perception (Lowenfeld's: Drawing Test, Imagine a Building Test, and the Haptic Word Association Test); Levenson's I.C.P. Scales; and a test of active/passive learning preference.

Subjects in condition 1 then played the videogame Battlezone for thirty minutes. A yoked partner in condition 2 watched a videotape of the games played by their matched partner. Subjects in the control condition watched a videotape of the television show M*A*S*H*.

After the half hour of game exposure, subjects participated in a coded interview to access their learning of the game details and spatial strategies employed. All subjects were then given the second half of the Guilford Zimmerman Spatial Visualization Test.

Results

No significant differences in performance were found between the interactive and observational conditions. Unlike the five hour intervention provided in the pilot study (Gagnon, 1983) the thirty minute videogame exposure had no effect on subsequent visualization scores. It may be that the thirty minutes of videogame exposure was not enough time to learn the underlying skills that transfer to other tasks.

Aptitude treatment interactions were found. Subjects pre-existing tendency toward a haptic style of thinking was found to have an effect on spatial visualization, game strategy and amount of detail remembered about the videogame when placed in the interactive versus the observational condition ($F(60)=4.34$ $p<.02$; $F(60)=7.03$ $p<.002$; $F(60)=4.55$ $p<.01$, respectively). Those subjects who scored high on haptic perception performed better when placed in the interactive condition, while those who scored low on haptic perception performed better in the observational condition.

Haptic thinkers tend to process and possibly encode information based on haptic or kinesthetic input. In the case of an interactive videogame, it may be proposed that the the ability to kinesthetically and physically respond to the high speed spatial manipulations is a requirement. In fact, expert videogame players (i.e. people who play a great deal of videogames) scored higher on haptic

perception. It may be that haptic thinkers process the fast paced spatial game information in a kinesthetic manner without transferring the information to visual imagery or verbal form.

In the observational videogame condition, subjects could not physically interact with the game. Since the haptic thinkers placed in this condition could not kinesthetically process the information, they may have been forced to decode the game information through other means and, as such, did not perform as well on the spatial and strategy measures.

Locus of control also seemed to play a role in how well the subjects performed in the two conditions. An interaction was found between beliefs in powerful others and details remembered $F(60)=4.01$ $p<.02$; game strategy $F(60)6.39$ $p<.003$ and spatial visualization $F(60)=6.46$ $p<.003$. Beliefs in the control of fate were also found to interact with game strategy $F(60)=3.90$ $p<.03$ and visualization $F(60)=7.56$ $p<.001$. Those subjects who strongly believed that outcomes are determined by forces beyond their control, tended to perform better when exposed to observational media. Since this form of media did not provide the users with personal control, it may have matched with their pre-existing expectations or world model.

Those subjects who did not believe that outcomes are determined by forces beyond their control, performed better when exposed to the interactive condition. This group appeared able to use control and performed better when provided with the option to do so. It may be proposed that this media environment (which provided user control) may have met more closely with their pre-existing beliefs about their control over events.

Preferences for interactive vs. spectator learning situations did not have an effect on subjects ability to perform with the two forms of media.

The most important finding was that individual differences were found to interact with ability to perform with the two types of media. A question can be raised concerning how individual differences will come to play with different content types. The next two studies in the series vary the content and examine different characteristics of the user.

Study 2- Interactive News (in progress)

The goal of the second study is: 1). to examine the influence of user control and interactive structure on learning from television news, and 2. to determine if modality preferences and pre-existing media usage patterns will influence ability to use interactive versus observational news media.

This study will examine characteristics of the media (user control & interactive structure); the task (learning of news content) and the learner (modality preferences, and media usage patterns).

On a daily basis most people are willingly or unwillingly bombarded with a stream of news information. 97% of all adults in the U.S. are exposed to news on some media very day, with the largest group being exposed to news on all three main news media (newspaper, television, and radio) (N.A.B., 1985). On an average weekday, two thirds of all adults watch at least one TV. news program. What happens when user control and interactive structure are added to traditional linear and passive media such as television news? Will this added interactivity effect recall of the news? The proposed study will compare recall of news items from interactive versus observational versions of the same content.

It is also hypothesized that the users pre-existing media patterns and modality preferences and abilities will influence their ability and willingness to use the interactive versus passive news media.

Pre-existing Media Usage Patterns: Newspapers (unlike TV and radio) already allow the user some degree of control. The user is not tied to a certain time frame or order. Users can browse or choose to read partial or whole stories in any order or depth they prefer. Newspapers readers use this control in different ways. Most newspaper readers (67%) claim that they read the paper page by page, while only 32% claimed to read only certain sections of the newspaper

(N.A.B. 1985). Regardless of how they choose to use it, newspaper readers are used to having choice. It may therefore be hypothesized that those people who choose newspapers as their primary source of news will be more receptive and willing to interact with television news when provided the option.

Television and radio are passive, linear media. Users of these media are tied to the time frame, order, and depth of coverage that is provided. Their only choice is to turn it on or off. People who tend to choose these passive media as their primary source of news, may be more resistant and less willing to use interactive media when provided with the option. The proposed study will examine the influence of subjects pre-existing media patterns on ability and willingness to use the interactive versus the observational versions of the television news.

Modality: There are four primary sources of news: newspaper,news magazines, radio and television news. Each of these media present the information through three different modes (print, audio, and visual, respectively). The modality in which the information is presented may also interact with the users pre-existing modality preferences and abilities.

Research has found that people receive and retain information differently through the different sensory channels (auditory, visual, and kinesthetic) (see Barbe and Swassing, 1979 for review). People not only have different modality strengths (i.e. receive information best through one sensory channel) but also have modality preferences (i.e. prefer to receive information through one sensory channel). It may be hypothesized that people will prefer to receive news information on the media that matches their pre-existing modality strengths and preferences. For example those subjects who rate high on audio modality may prefer to receive the news through the radio. It could be further hypothesized that those subjects that rate high on kinesthetic modality may prefer to receive and perform better with the interactive version of the news. The proposed study will examine the relationship between existing media patterns and media modality.

Methods Study 2

An interactive videodisc version of the CBS Evening news is being constructed for use in the study. The CBS evening news was recorded between Oct.

1, 1985 to Jan. 1, 1986. A series of clips were assembled for use as the core material for the videodisc. These clips will be presented with graphic over-lay buttons which will allow users to access further information such as maps and information to augment the news stories. The basic model is based on the idea that users may someday be able to down-load their evening news with digital data addresses that allow the user to access other data bases over the telephone lines or on local storage media such as CD. For example, if the anchor man mentioned a place that the viewer was unfamiliar with, he/ she could push a button which would access a local or remote database and display a map. He /she could then resume the news program after they were finished viewing the map.

This videodisc will be designed so that it may be used interactively or viewed linearly without the branching structure. Ninety subjects will be randomly assigned to one of three conditions. Those in condition 1 will interact with an interactive version of the television news. A yoked partner in condition 2 will watch a videotape of the interactive news presented to their matched partner. Subjects in condition 3 will watch a linear version of the same television news without branching structures.

Study 3: Interactive Dallas (in progress)

The goal of the third study is to: 1. determine if interactive structure and user control will interfere with emotional involvement and identification with characters in entertainment content; and 2. to determine if pre-existing media usage patterns and scores on empathy will interact with emotional involvement in interactive versus observational media.

This study will examine characteristics of the media (user control & interactive structure) the task (vicarious emotional involvement) and the learner (emotional involvement, empathy, and character identification).

How will the addition of interactive structure and user control influence

traditional entertainment television viewing? We have all felt our hearts beating and our hands clinched white with anticipation over the fate of a television character; or felt our eyes involuntarily well with tears at a sentimental scene. It is this emotional involvement, that some would argue, is at the heart of entertainment television viewing. It could be that viewers watch movies primarily for the purpose of achieving this vicarious emotional experience. In fact television programs are often evaluated based on how well they manage to evoke these cognitive or affective empathic responses in the viewer. Will the addition of an interactive structure and user control influence a television programs ability to evoke these emotional and empathic responses?

It may be hypothesized that the addition of an interactive structure will interfere with a viewer's ability to suspend reality and get involved. Todays systems require a structure to be present to inform the user when he/she can interact and what choices can be made or what functions can be performed. These structures not only are physically present on the screen but also sometimes require that the motion stop until an input is received. After a choice is made the screen often goes black for a number of seconds while the disc player searches the next scene. It is not clear how much these these structures and interruptions interfere or disrupt the viewers emotional involvement or concentration.

It might further be hypothesized that requiring the users to think and choose may also interfere with emotional involvement processes. The addition of user control may require the viewers to consciously remain themselves. In order to make choices and take an active part in the program, the viewers may be required to perform a meta cognition; i.e. be aware of their part and choices, while still abandoning themselves so that they can experience vicariously the emotional responses of the characters. This self awareness may interfere with the empathy and identification processes needed for true emotional involvement.

The proposed study will examine the influence of user control and interactive structure on viewer empathy, physiological arousal, and emotional involvement with movie content and characters.

Empathy

Feldstein (1979) points out that the term empathy has evolved in meaning since it's original presentation by Carl Rogers (1957). Gladstein (1977) sees empathy as involving two elements the cognitive and the affective. Cognitive empathy is defined as involving the ability to think like others do, and to be able to take the role of the other consciously. Affective empathy is referred to as the taking of the feelings, attitudes or emotions of another. Cognitive and affective empathy together involve experiencing the feelings of others affectively, and cognitively decoding and encoding the information from others.

The affective empathetic response to film is a spontaneous and involuntary activation of feeling and fantasies. An individual viewing a film loses consciousness of his/her identity and merges completely with the object of contemplation. Cohen Feldstein (1979, p 10) summarized the film empathy process as involving "1) affective empathy - the aesthetic state of being, 2) cognitive empathy- taking the role of another; 3) suspension of personal beliefs and values; 4) communication of empathy and 5) additive empathy- the sensing of meanings which one is scarcely aware".

Although the literature often refers to identification and empathy interchangeably, a subtle distinction is sometimes made between these two processes. In identification, the viewer puts him/herself in the place of a character and monentarily feels that what is happening to that character is happening to him/her. Maccoby & Wilson (1957) claim that although the viewer may reproduce very little of the gross motor behavior of the screen character, he/she does reproduce covertly the emotions of the character. In this process the viewer usually selects a character who has similar traits and social characteristics such as sex, age and race (Maccoby, Wilson, 1957). Thus, to some degree, the extent of identification may be determined by the amount of perceived similarity between character and viewer. The identification process therefore breaks down if the character behaves in a manner which does not match the viewers idea of how to behave in the observed situation.

Empathy, on the other hand, is a simple sharing of emotions, where the viewer suspends his/her own perspective and accepts that of the character. A

viewer can empathize with a character with which he/she shares little in common with. The proposed study will examine the influence of interactive structure and user control on empathy and identification processes.

Physiological Arousal

It is a well documented fact that emotional excitement can cause a variety of organic changes to take place in the body. These include changes in blood pressure, heart rate, breathing, stomach acidity, and activity of liver and sweat glands (Crafts, Schneirla, Robinson, & Gilbert, 1950). This research on autonomic arousal indicates that different autonomic systems have distinct responses to various types of mental stimuli. Heart rate is believed to respond to thinking processes while changes in the sweat gland activity are believed to be indicative of the level of emotional arousal. (Taylor & Epstein, 1956).

This increase in the activity of the sweat glands produces a reduction in the electrical resistance of the skin which is called the galvanic skin response (GSR) (Craft et all., 1950). Measures of GSR are extremely sensitive to emotional changes and provide a nearly instantaneous response to emotional stimuli (e.g. Montagu, & Coles, 1966; Thomas, & Korr, 1957). This measure is therefore a valuable tool for measuring emotional response to film or television (e.g. Norwood, 1978). This study will incorporate a continuous measure of GSR. If interactive structure and user control influence emotional involvement, differences in galvanic skin response should be found between the interactive and observational conditions.

Method Study 3

An interactive videodisc will be constructed of the television program Dallas. A series of clips will be recorded and a videodisc is being designed. A menu structure will be explored that allows the user to select the order in which scenes are viewed. Users may also choose to access further information (text or still images) on the individual characters. The use of flow charts depicting the family tree and dating patterns between characters will also be explored.

Ninety subjects will be randomly assigned to one of three conditions. The subjects in condition 1 will be provided with user control and will interact with the interactive version of Dallas, subjects in condition 2 will watch a videotape of the interactive version , and the subjects in condition 3 will watch a linear version of Dallas. All subjects will be premeasured on empathy and a number of background variables. A continuous measure of physiological arousal (GSR) will be taken during viewing and post measure ratings of character identification, liking, and emotion impact will be collected.

Conclusion

Although interactive television is not yet an alternative, the technology which will make it viable is becoming more widespread. In Europe and Japan consumer use of videodisc technology is gaining popularity. Trials are also underway which will provide broadband services through interactive fiber optic systems. Now is the time to determine if people will use interactive media, how they will use them, and how these new media should be designed. A number of structural and design alternatives will be explored in the videodiscs which will be used in the proposed study series.

Research should also be conducted to understand how these new media may influence the people who ultimately choose to use them. This series of studies will provide some exploratory results on how user control and interactive structuring of information may influence learning and entertainment viewing and how individual differences may effect the user's ability to use interactive media. As user control and interactive structure become integrated into more technologies the need for answers may become vital for a number of next generation media technologies.

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